

## **Group Delay Measurements of Photonic Crystal Cavities**

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We have investigated the group delay of light propagating through photonic crystal (PhC) resonators. The resonators are defined in 250nm thick GaAs membranes. The design of the resonators is based on a PhC heterostructure, which combines waveguide sections with different lattice constants along a W1 waveguide to confine the light. The 'mirrors' of the resonator have a lattice constants of 400nm along the waveguide, the lattice constant of the cavity is 410nm. The lattice constant perpendicular to the waveguide remains unchanged in order to maintain matching lattices.

The group delay was measured by detecting the phase shift of a microwave signal which was modulated onto the light of a tunable laser source with an emission wavelength of 1.5  $\mu\text{m}$ . The group delay was found to increase linearly with the quality factor of the resonator, in good agreement with the prediction of a model where the PhC resonator is replaced by an equivalent Fabry-Perot resonator. A maximum group delay of 132ps was observed for a resonator with a quality factor of 82000. The mirror segments of this resonator had a length of 12 lattice periods. Taking this as a measure of the length of the resonator, we have achieved an effective propagation speed of  $7.88 \cdot 10^4 \text{m/s}$ , which is equivalent to  $c/3800$ .